

## Environmental toxins enter the brain tissue of polar bears

Scientists from Denmark and Canada are worried by their new findings showing that several bioaccumulative perfluoroalkyl substances (PFASs) are crossing the blood brain barrier of polar bears from Scoresby Sound, East Greenland.

2013.07.23 | JENS CHRISTIAN PEDERSEN



Scientists have been monitoring the polar bear for contaminants in East Greenland over the past 30 years. They are worried by the findings of bioaccumulated perfluoroalkyl substances (PFASs) in the brain. Photo: Rune Dietz, Aarhus University.

Perfluoroalkyl substances (PFASs) and precursor compounds have been used in a wide variety of commercial and industrial products over the past six decades. Applications include water and oil repellent coatings, e.g. for textiles, paper products, carpets and food packaging, pharmaceuticals and surfactants in cleaning products and fire-fighting foams. PFASs are highly resistant to chemical, thermal and biological degradation.

PFASs and their precursor compounds have shown a dramatic increase and dispersal around the world over the past four decades. An increasing amount of information is becoming available on the toxicity of these compounds. Hence, studies have documented the toxicity of PFASs on wildlife and human

### News archive

- > **2018**
- > August 2018: 7 articles
- > July 2018: 3 articles
- > June 2018: 6 articles
- > May 2018: 8 articles
- > April 2018: 3 articles
- > March 2018: 6 articles
- > February 2018: 8 articles
- > January 2018: 15 articles
- > **2017**
- > December 2017: 7 articles
- > November 2017: 17 articles
- > October 2017: 10 articles
- > September 2017: 14 articles
- > August 2017: 5 articles
- > July 2017: 8 articles
- > June 2017: 10 articles
- > May 2017: 16 articles
- > April 2017: 14 articles
- > March 2017: 21 articles
- > February 2017: 11 articles
- > January 2017: 14 articles
- > **2016**
- > December 2016: 11 articles
- > November 2016: 10 articles
- > October 2016: 10 articles
- > September 2016: 9 articles

health, including carcinogenesis, genotoxicity and epigenetic effects as well as reproductive and developmental toxicities, neurotoxicity, effects on the endocrine system and immunotoxicity.

## Bioaccumulative PFASs enter all parts of the brain

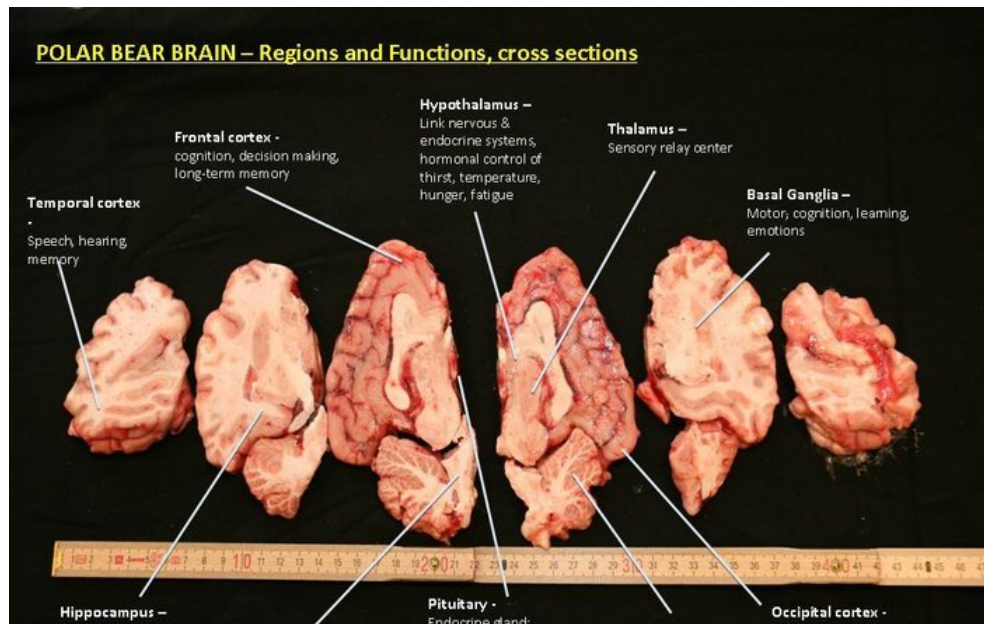
Despite the fact that the liver is considered the major repository in the body for most PFASs, some shorter chain compounds from this grouping have previously been reported in the brain of chicken embryos, suggesting that they are able to cross the blood–brain barrier.

Previous studies have shown a dramatic biomagnification of several PFASs, and particularly one known as perfluorooctane sulfonate (PFOS) as well as several compounds of the perfluorinated carboxylate (PFCAs) grouping in polar bears. PFOS have been shown to be at concentrations in the liver that are 100 fold higher than the ringed seals on which they are predated. In a new study, Arctic researchers from Carleton University in Canada and Aarhus University in Denmark have used the polar bear as a sentinel species for humans and other predators in the top of the food chain. The researchers demonstrated accumulation of PFOS and several PFCAs in eight brain regions of polar bears collected from Scoresby Sound, East Greenland. Dr Robert Letcher, Carleton University, explains:

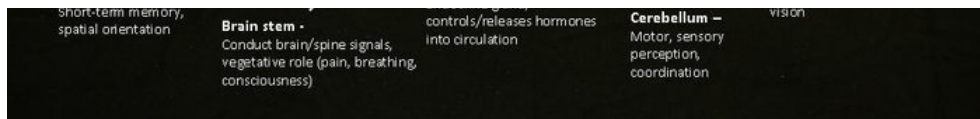
“We know that fat soluble contaminants are able to cross the brain-blood barrier, but is it quite worrying that the PFOS and PFCAs, which are more associated with proteins in the body, were present in all the brain regions we analysed.”

Professor Rune Dietz, Aarhus University, is also worried about the results:

“If PFOS and PFCAs can cross the blood-brain barrier in polar bears, it will also be the case in humans. The brain is one of the most essential parts of the body, where anthropogenic chemicals can have a severe impact. However, we are beginning to see the effect of the efforts to minimise the dispersal of this group of contaminants.”



- › August 2016: 7 articles
- › July 2016: 9 articles
- › June 2016: 17 articles
- › May 2016: 16 articles
- › April 2016: 16 articles
- › March 2016: 15 articles
- › February 2016: 15 articles
- › January 2016: 11 articles
- › **2015**
- › December 2015: 11 articles
- › November 2015: 13 articles
- › October 2015: 12 articles
- › September 2015: 10 articles
- › August 2015: 16 articles
- › July 2015: 11 articles
- › June 2015: 17 articles
- › May 2015: 15 articles
- › April 2015: 14 articles
- › March 2015: 13 articles
- › February 2015: 21 articles
- › January 2015: 19 articles
- › **2014**
- › December 2014: 16 articles
- › November 2014: 14 articles
- › October 2014: 11 articles
- › September 2014: 20 articles
- › August 2014: 11 articles
- › July 2014: 9 articles
- › June 2014: 19 articles
- › May 2014: 9 articles
- › April 2014: 11 articles
- › March 2014: 15 articles
- › February 2014: 15 articles
- › January 2014: 18 articles
- 2013**



Different functional parts of the Greenland polar bear brain were investigated for transfer of contaminants over the blood-brain barrier. The inner regions of the brain closer to incoming blood flow (pons/medulla, thalamus, and hypothalamus) contained consistently higher concentrations of perfluorooctane sulfonate (PFOS) and several perfluorinated carboxylates (PFCAs) compared to outer brain regions (cerebellum, striatum, and frontal, occipital, and temporal cortices). Photo: Rune Dietz, Aarhus University.

### Select environmentally labelled products

The eight carbon chain PFOS and perfluorooctane carboxylate (PFOA) are PFASs that have been phased out and are no longer produced in the Western world. However, production in China, today the only known production source of PFOS and PFOA, has increased by roughly a factor of 10, since it was phased out in the USA. Unfortunately, no emission inventory is so far available from this region. Furthermore, replacements for PFOS and PFOA are now marketed and produced in the USA and China, for example, which generally have perfluorinated carbon chains that are shorter or branched.

Another recent study from Aarhus University documents that PFOS concentrations in Greenlandic polar bears and ringed seals started to decline after 2006. Other wildlife populations closer to the sources in Europe and North America have shown a decline prior to the Greenlandic animals. Rune Dietz comments:

“It is promising to see that the PFAS are on the decline. This development should be encouraged by the authorities globally.

In the meantime, my best advice to the consumers is to go for environmentally labelled products. But avoiding products is difficult, because PFASs are so widespread in many kind of products and they are rarely declared.”

## FACTS

### With fluorine in the tail

Perfluoroalkyl substances (PFASs) constitute a group of compounds where one end of the molecule consists of a carbon chain in which all the hydrogen atoms are replaced by fluorine atoms. This so-called perfluoroalkyl ‘tail’ can be short or long, but the strong C-F bonds make the tail more or less impossible to degrade, compared to the more well-known CFC-bonds. The best known PFAS is PFOS with an eight-chained perfluoroalkyl tail.

F F F F F F F F

- › December 2013: 16 articles
- › November 2013: 17 articles
- › October 2013: 10 articles
- › September 2013: 14 articles
- › August 2013: 11 articles
- › July 2013: 16 articles
- › June 2013: 15 articles
- › May 2013: 14 articles
- › April 2013: 14 articles
- › March 2013: 9 articles
- › February 2013: 15 articles
- › January 2013: 13 articles
- › **2012**
- › December 2012: 1 item

